Instructions: Upload LEGIBLE, COMPLETE solutions to Gradescope before 11:59pm on 15 November 2021.

1. Is the vector field $\mathbf{v}(x, y)$ conservative? If yes, compute a potential function of $\mathbf{v}$.
   (a) $\mathbf{v}(x, y) = \left\langle \exp(x + y^2), y \exp(x + y^2) \right\rangle$
   (b) $\mathbf{v}(x, y) = \langle \sin(x + y) + x \cos(x + y) - y \sin(x), x \cos(x + y) + \cos(x) \rangle$
2. Compute the line integral $\int_C xye^{yz} \, dy$ for C parameterized by $\mathbf{r}(t) = (t, t^2, t^3)$ on $0 \leq t \leq 1$.
3. Use the Fundamental Theorem of Line Integrals to compute the line integral $\int_C \mathbf{v} \cdot d\mathbf{r}$ for $\mathbf{v}(x, y, z) = \langle yz, xz, xy + 2z \rangle$ on the line segment from $(1, 0, -2)$ to $(4, 6, 3)$.
4. Use Green's Theorem to compute $\int_C ye^x \, dx + 2e^x \, dy$ along C the boundary of the rectangle $[0, 3] \times [0, 4]$.
5. Use Green's Theorem to compute $\int_C \mathbf{v} \cdot d\mathbf{r}$ for $\mathbf{v}(x, y) = \langle y \cos(x) - xy \sin(x), xy + x \cos(x) \rangle$ and C the clockwise-oriented triangle with vertices $(0, 0)$, $(0, 3)$, and $(1, 0)$.
6. Compute the curl and divergence of the vector fields below.
   (a) $\mathbf{v}(x, y, z) = \left\langle xy, xy^2 z, x + 2y + 3z \right\rangle$
   (b) $\mathbf{v}(x, y, z) = \left\langle \sin(xyz), xy, \cos(x^2 z) \right\rangle$
7. Is $\mathbf{v}(x, y, z) = \langle x, y, z \rangle$ the curl of any vector field? Justify completely.